CLAIMS

What is claimed is:

1. An apparatus for attaching a tube segment to a bag by fusing them together in an aseptic form, fill and seal operation, comprising:

a sterile processing chamber in which a sterilized tube segment and a pair of opposing wall portions of a bag film to form a flexible bag are to be located, the sterilized tube segment having an open end, the opposing wall portions defining an interior space therebetween;

a tube inserter at least partially located within the processing chamber and arranged to grip the tube segment and place the tube segment between the wall portions of the bag film in the sterile processing chamber; and

at least one member for fusing the tube segment between the wall portions of the bag film so that the open end of the tube segment is in communication with the interior space in the bag.

2. The apparatus of claim 1, further comprising:

a tube sterilization chamber in which tubing from a supply of tubing is introduced, the tube sterilization chamber being in communication with the sterile processing chamber.

3. The apparatus of claim 2, wherein the tube sterilization chamber includes a hydrogen peroxide bath.

4. The apparatus of claim 3, further comprising a dryer located downstream of the bath.

5. The apparatus of claim 4, wherein the dryer comprises a heated sterile air supply.

6. The apparatus of claim 3, further comprising a plurality of rollers located in the bath, the tubing extending between the rollers to provide a desired dwell time to ensure sterility.

7. The apparatus of claim 2, wherein the tube sterilization chamber is at least one of a hydrogen peroxide vapor chamber, a hydrogen peroxide bath, an ultraviolet radiation chamber, an ion radiation chamber, or a high intensity pulsed light chamber.

8. The apparatus of claim 1, further comprising a hydrogen peroxide vapor generator connected to the sterile processing chamber that feeds hydrogen peroxide vapor into the chamber.

9. The apparatus of claim 8, wherein the hydrogen peroxide vapor is at least at a 31% concentration.

10. The apparatus of claim 1, further comprising a tube supply unwind stand with a supply of tubing.

11. The apparatus of claim 10, wherein the unwind stand includes a brake to keep tension on the tubing.

12. The apparatus of claim 10, wherein the supply of tubing includes pre-crimped, irradiated tubing so that an inside of the tubing is sterile.

13. The apparatus of claim 10, wherein supply of tubing comprises tubing crimped only at each end, the apparatus further comprising at least one pre-heat section to preheat a portion of the tubing, and a crimper located downstream of the preheater to crimp the tubing into sealed tube segments.

14. The apparatus of claim 10, further comprising:

a cutter located in a sterile area in or in communication with the sterile processing chamber to cut the tube segment from the supply of tubing.

15. The apparatus of claim 14, wherein the tube cutter comprises opposing blades that are driven together to cut the tubing into tube segments.

16. The apparatus of claim 15, wherein the opposing blades mounted to at least one rotary actuator, swing toward one another to cut the tubing.

17. The apparatus of claim 14, wherein the supply of tubing is pre-crimped, and the apparatus further comprises a crimp position sensor in proximity to the tube cutter, the crimp position sensor being adapted to detect a position of the crimp to allow a location of cut to be positioned adjacent to the crimp.

18. The apparatus of claim 14, wherein the tube cutter is mounted for movement by an actuator to adjust a position of the tube cutter based on a crimp in the tubing.

19. The apparatus of claim 14, wherein the cutter is pre-heated.

20. The apparatus of claim 10, further comprising opposing drive wheels to grip and pull the tubing from the supply of tubing.

21. The apparatus of claim 20, further comprising a dancing bar located in a path of the tubing, the dancing bar is moveable between upper and lower positions, and a sensor connected to the dancing bar which signals the drive wheels to feed additional tubing when the dancing bar approaches the upper position.

22. The apparatus of claim 10, wherein the inserter comprises opposing jaws that are moveable toward one another to grip an end of tubing from the supply of tubing prior to the tubing being cut from the supply of tubing to form the tube segment.

23. The apparatus of claim 22, wherein the opposing jaws are moveable toward and away from the bag film.

24. The apparatus of claim 23, wherein the opposing jaws are moved linearly by linear actuators connected to the jaws to insert the open end of the tube segment between the sides of the bag film.

25. The apparatus of claim 1, further comprising a bag film splitter that separates the opposing wall portions of the bag film from one another at a tube insertion site prior to the inserter placing tube segment in position.

26. The apparatus of claim 25, wherein the bag film splitter comprises two arms joined in a V-shaped arrangement that moves from a first position, in which only a first part of the arms at a base of the V are located between the opposing wall portions of the bag film so that the bag wall portions are not separated, to a second position, in which spaced apart ends of the arms are moved between and separate the wall portions to allow insertion of the tube segment.

27. The apparatus of Claim 1, wherein the at least one member is arranged to provide ultrasonic energy to the open end of the tube located between the wall portions of said bag.

28. The apparatus of claim 1, wherein the at least one member comprises at least one sealing jaw for heat sealing the open end of the tube segment between the wall portions of the bag film.

29. The apparatus of claim 28, wherein there are two opposed heat sealing jaws which include a recess complementary to and smaller than a diameter of the tube segment.

30. The apparatus of claim 29, wherein the heat sealing jaws include a fin seal for an edge of the bag.

31. The apparatus of claim 30, wherein the heat sealing jaws each include a plurality of heating zones that are controlled independently to provide a different heat sealing temperature in an area of a seal between the bag wall portions to form a bag edge seam than an area of a seal between the bag wall portions and the tube segment.

32. The apparatus of claim 31, wherein the heat sealing jaws are heated to 350 - 450°F for heat sealing the bag wall portions to the tube segment, and from 250-350°F for heat sealing the bag wall portions together to form the bag edge seam.

33. The apparatus of claim 29, wherein the heat sealing jaws are moveable from a first, non-contact position, away from the bag film, to a second, sealing position, in contact with the bag film, to seal the tube segment between the wall portions of the bag film.

34. The apparatus of claim 29, wherein the heat sealing jaws include a tube sealing recess with a flattened profile having a circumference that is smaller than a circumference of the tube segment.

35. The apparatus of claim 29, further comprising a controller to control a tube cut position, a tube feed rate, a temperature of heat sealing jaws and a sealing time.

36. The apparatus of claim 1, wherein tubing from a tubing supply is introduced into the sterile processing chamber, the apparatus further comprising a pressure sensor to determine if a sterile environment in the sterile processing chamber is breached, and a tubing crimper which crimps the tubing upon the pressure sensor detecting a loss of pressurization to maintain sterility of the tube supply.

37. A flexible bag with a directly connected dispensing tube connected under aseptic conditions, comprising:

a polymeric bag formed of a polymeric film having two wall portions overlying one another and connected together via a fold which forms a common connected, non-seamed edge, and a plurality of other common peripheral edges which are fused together to form edge seams, the wall portions, the edge seams and the non-seamed edge defining an interior space of the bag; and

a sterile tube segment having an open end, inserted between the two wall portions of the film along one of the common peripheral edges and secured thereto by a fused joint created under aseptic conditions, the open end of the tube being in communication with the interior space, the tube having a closed end, located outside of the film.

38. The bag of claim 37, wherein a food product is placed in the bag prior to heat sealing a final one of the common peripheral edges.

39. The bag of claim 37, wherein the tube segment is an irradiated thermoplastic elastomer.

40. The bag of claim 37, wherein the tube segment is formed from polypropylene.

41. The bag of claim 37, wherein the tube segment is irradiated with at least 30 kGy to improve bonding to the film.

42. The bag of claim 37, wherein the tube segment comprises a blend of polyethylene and polypropylene.

43. The bag of claim 37, wherein the tube segment comprises KRAYTON.

44. The bag of claim 37, wherein the bag film comprises at least one of EVOH, Olefin, LDPE, LLDPE, ULDPE and PET.

45. The bag of claim 37, wherein the bag film is multilayer, and includes a layer of at least one of EVOH, Olefin, LDPE, LDPE, ULDPE and PET.

46. The bag of claim 37, wherein the edge seams and the fused joint are heat fused.

47. A method of attaching a tube to a bag by fusion during manufacture in an aseptic form, fill and seal operation, comprising:

providing a film having two wall portions for forming a bag with an interior space;

providing a sterile tube segment having an open end;

inserting the open end of the tube segment between the wall portions; and

fusing the tube segment to the film with the open end of the tube in communication with the interior space.

48. The method of claim 47, further comprising:

feeding tubing through a sterilizing area into a sterile environment; and

cutting the tube segment from a free end of the tubing.

49. The method of claim 48, further comprising:

sterilizing an outside of the tubing in a hydrogen peroxide bath; and

drying the tubing with a dryer located downstream of the bath.

50. The method of claim 49, further comprising:

feeding the tubing through a plurality of rollers located in the bath to provide a desired dwell time to ensure sterility.

51. The method of claim 48, further comprising:

feeding hydrogen peroxide vapor into the sterilizing area to sterilize an outside of the tubing.

52. The method of claim 48, further comprising:

sterilizing an outside of the tubing using at least one of a hydrogen peroxide vapor chamber, a hydrogen peroxide bath, an ultraviolet radiation chamber, an ion radiation chamber, or a high intensity pulsed light chamber.

53. The method of claim 48, further comprising:

unwinding the tubing from a roll on an unwind stand; and

applying tension to the tubing.

54. The method of claim 48, further comprising:

supplying the tubing with a plurality of evenly spaced apart crimps, such that the tubing includes a plurality of sealed, sterile inner segments.

55. The method of claim 48, further comprising:

providing the tubing crimped only at each end and having a single sterile inner volume;

preheating a portion of the tubing; and

crimping an end segment of the tubing to form a separate, sealed tube segment.

56. The method of claim 48, further comprising:

preheating the cutter for cutting the tube segment.

57. The method of claim 48, further comprising:

supplying the tubing with a plurality of evenly spaced apart crimps, such that the tubing includes a plurality of sealed, sterile inner segments;

sensing a position of a crimp for the last tubing segment;

adjusting a location of the cut so that the tubing is cut adjacent to the crimp.

58. The method of claim 48, further comprising:

gripping and pulling the tubing from a tube supply using opposing drive wheels:

sensing an amount of slack tubing using a dancing bar located along a path of the tubing; and

feeding additional tubing when the dancing bar approaches an upper position.

59. The method of claim 48, wherein the method produces a plurality of bags in sequence, the method further comprising:

gripping a free end of the tubing with opposing gripper jaws prior to cutting the tube segment to be inserted into a next bag from the tubing, the tube segment to be inserted into a next bag being produced.

60. The method of claim 59, further comprising:

linearly moving the opposing jaws with the tube segment toward the film.

61. The method of claim 47, further comprising:

separating the wall portions in an insertion area prior to insertion of the tube segment.

62. The method of claim 47, wherein the fusing takes place by heat sealing.

63. The method of claim 62, wherein the step of heat sealing includes:

providing heat sealing jaws with a recess complementary to and smaller than a diameter of the tube segment;

pre-heating the heat sealing jaws; and

moving the heat sealing jaws into contact with the film from opposing sides with the tube segment located in a complementary position to the recess.

64. The method of claim 63, further comprising:

forming a fin seal for an edge of the bag with the heat sealing jaws simultaneously with heat sealing the tube segment between the bag sides.

65. The method of claim 63, further comprising:

moving the heat sealing jaws from a first, non-contact position, away from the film, to a second, sealing position in contact with the film to seal the tube segment between the sides of the bag; and

moving the heat sealing jaws back to the first position to allow the bag to index forward to a next station.

66. The method of claim 47, further comprising:

filling the bag with a viscous or semi-viscous product prior to sealing a final one of the edges.

67. A method of attaching a tube to a bag, comprising placing a barbed fitment into the bag prior to sealing the bag;

locating the fitment in the bag;

pressing a tube over the fitment so that the fitment extends through the a sidewall of the bag.